U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.5.1.5 SITE PROXIMITY MISSILES (EXCEPT AIRCRAFT)

REVIEW RESPONSIBILITIES

Primary - ~~Siting Analysis~~Plant Systems Branch ~~(SAB)~~(SPLB)[1]

Secondary - ~~NONE~~Civil Engineering and Geosciences Branch (ECGB)[2]

I. AREAS OF REVIEW

The staff reviews the nature and extent of offsite activities identified in SRP Section 2.2.1-2.2.2 to determine whether any missiles resulting from such activities, other than aircraft (aircraft hazards are reviewed separately in SRP Section 3.5.1.6), have the potential for adversely affecting structures, systems, and components (SSC) ~~essential~~important[3] to safety. In the event that an offsite activity has the potential for missile production (e.g., explosion) and is found to be a design basis event according to SRP Section 2.2.3, the staff reviews the plant design to determine whether the plant is adequately protected against the effects of the postulated missiles. The ~~Structural Engineering Branch (SEB) on request by SAB~~ECGB on request by SPLB[4] reviews the missile impact effects on the ~~safety-related~~[5] SSC.

Review Interfaces:[6]

The following reviews are coordinated by the SPLB and the results used to complete the overall SPLB evaluation of the protection against site proximity missiles.[7]

1. The SSC that should be protected against missiles are identified in accordance with SRP Section 3.5.2 as part of the primary review responsibility of the ~~Auxiliary Systems Branch (ASB)~~SPLB[8].

2. The ~~Siting Analysis Branch (SAB)~~ECGB[9] identifies and characterizes any offsite missiles (in accordance with SRP sections 2.2.1-2.2.2 and 2.2.3)[10] that are required to be accommodated within the plant design basis in order to adequately protect ~~adequately~~[11] the safety-related SSC.

For those areas of review identified above as part of the review under other SRP sections, t~~T~~he acceptance criteria ~~necessary for the review~~ and their methods of application ~~for the above reviews~~ are contained in the referenced SRP sections.[12]

II. ACCEPTANCE CRITERIA

~~SAB~~SPLB[13] acceptance criteria are based on meeting the relevant requirements of one of the following regulations:

1. 10 CFR Part 100, §100.10 indicates that the site location, in conjunction with other considerations (such as plant design, construction, and operation), should insure a low risk of public exposure. This requirement is met if the probability of site proximity missiles impacting the plant and causing radiological consequences greater than 10 CFR Part 100 exposure guidelines is less than about 10^{-7} per year (see SRP Section 2.2.3). If the results of the review do not indicate that the above criterion is met, then the acceptance criterion described in 2 below applies.

2. General Design Criterion (GDC) 4 of 10 CFR Part 50, Appendix A, requires that ~~structures, systems, and components (~~SSC~~)~~[14] important to safety be appropriately protected against the effects of missiles that may result from events and conditions outside the nuclear power unit. The plant complies with GDC 4 and is considered adequately protected against site proximity missiles if the following criterion is met: The SSC important to safety are capable of withstanding the effects of the postulated missiles without loss of safe shutdown capability and without causing a release of radioactivity which would exceed 10 CFR Part 100 dose criteria.

Technical Rationale:[15]

The technical rationale for application of the above acceptance criteria to site proximity missiles (except aircraft) is discussed in the following paragraphs.

1. 10 CFR Part 100, §100.10 establishes site requirements in conjunction with other design features regarding ensuring a low risk of public exposure. A probability of less than 10^{-7} per year has been established as an NRC staff objective for meeting the requirements of 10 CFR Part 100. In regard to missiles generated by explosions, Regulatory Guide 1.91 indicates that it is the judgment of the NRC staff that, if the exposure rate can be shown to be less than 10^{-7} per year, the risk of damage due to explosions is sufficiently low. Regardless of the source of site proximity missiles, missile hazards that have the potential for causing onsite accidents leading to the release of significant quantities of radioactive fission products, thus posing an undue risk of public exposure, should have a sufficiently low probability of occurrence. Meeting the probability objective in regard to site proximity missiles and 10 CFR Part 100

exposure guidelines provides a high level of assurance that individuals will not be exposed to excessive radiation doses.

2. GDC 4 establishes requirements that SSC important to safety be appropriately protected against dynamic effects, including the effects of missiles that may result from events and conditions outside the nuclear plant. Offsite activities that are determined to be a design basis event, such as an explosion, could have the potential for missile generation. The initiation of externally generated missiles is a dynamic effect and the effects of those missiles on SSC important to safety must be evaluated. Protecting those SSC that are important to safety from the effects of externally generated missiles prevents failure of those systems required for safe shutdown capabilities and prevents the release of radioactivity which might cause doses in excess of the 10 CFR Part 100 guidelines.

III. REVIEW PROCEDURES

The reviewer selects and emphasizes aspects of the areas covered by this SRP section as may be appropriate for a particular case. The judgment on areas to be given attention and emphasis in the review is based on an inspection of the material presented to see whether it is similar to that recently reviewed on other plants and whether items of special safety significance are involved. The review of site proximity missiles is site specific and therefore is not within the scope of design certification. The review and evaluation of site proximity missiles is performed using the following procedures:[16]

1. The identification and description of ~~accidents~~events[17] which could possibly generate missiles is obtained from the review performed in accordance with SRP Section 2.2.1-2.2.2 and SRP Section 2.2.3.

2. The SSC identified by ~~ASB~~SPLB[18] in reference to SRP Section 3.5.2 are reviewed with respect to missile vulnerability. Using conservative assumptions, and experience gained from past reviews on similar SSC missile interactions, a determination is made of those portions of the plant which clearly have the potential for unacceptable missile damage. If all SSC appear to be adequately protected against the effects of the postulated missiles, then the review is terminated and evaluation findings are written in terms of design basis considerations (See subsection II.2 of this SRP section).

3. The total probability of the missiles striking a vulnerable critical area of the plant is estimated. The total probability per year (P_T) may be estimated by using the following expression:

$$P_T = P_E \times P_{MR} \times P_{SC} \times P_p \times N$$

where:

P_E = probability per year of design basis event obtained from the review performed under SRP Section 2.2.3,

P_{MR} = probability of missiles reaching the plant,

P_{SC} = probability of missiles striking a vulnerable critical area of the plant,

P_p = probability of missiles exceeding the energies required to penetrate to vital areas (e.g., based on wall thickness provided for tornado missiles), or producing secondary missiles which could damage vital equipment, and

N = number of missiles generated by the design basis event.

P_p may be assumed to be equal to 1 as a first step in the analysis. If P_T thus calculated is greater than 10^{-7} per year, then missile effects on SSC should be estimated by ~~SEB~~ECGB[19] on request by ~~SAB~~SPLB[20]. The request should be accompanied by a specified missile description, including missile size, shape, weight, energy, material properties, and trajectory.

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[21]

IV. EVALUATION FINDINGS

Based upon the nature of activities around the site and the review performed, the staff provides an evaluation in one of the following forms, to be included in the staff's safety evaluation report.

1. The staff concludes that the site location, in conjunction with other considerations (such as plant design, construction, and operation) is acceptable and meets the requirements of 10 CFR Part 100, §100.10. This conclusion is based on the information provided by the applicant and reviewed by the staff which demonstrates that the probability of site proximity missiles adversely affecting safety-related structures, systems and components (SSC)[22] is acceptably low (within the criteria given in SRP Section 2.2.3), and that the site location has been determined to insure a low risk of public exposure due to the hazard of site proximity missiles.

2. The staff concludes that the protection for ~~structures, systems, and components~~SSC[23] important to safety is acceptable and meets the requirements of General Design Criteria 4 of Appendix A to 10 CFR Part 50. This conclusion is based on the information provided by the applicant and reviewed by the staff which identified potential missiles that could adversely affect ~~safety-related structures, systems, and components~~SSC requiring protection from externally generated missiles[24] and which demonstrates that these ~~structures, systems, and components~~SSC[25] have adequate barriers protecting them from the effects of missiles such that radiation exposures in excess of those given in 10 CFR Part 100 will not be exceeded.

3. Information provided by the applicant and reviewed by the staff has led us to identify potential missiles which could adversely affect ~~safety-related structures, systems, and components~~SSC important to safety that warrant detailed evaluation of their protection

against such externally generated missiles[26]. However, some of these ~~structures, systems, and components~~SSC[27] have adequate barriers protecting them from the effects of such missiles in accordance with the requirements of GDC 4 of Appendix A to 10 CFR Part 50, such that radiation exposures in excess of those given in 10 CFR Part 100 will not be exceeded. The remaining ~~safety-related structures, systems, and components~~SSC[28], although vulnerable to the potential effects of identified missiles, have a sufficiently low probability (within the criteria given in SRP Section 2.2.3) of unacceptable damage (on the basis of considerations such as low strike probability, or adequate separation and redundancy) such that the risk of public exposure is low and in conformance with 10 CFR Part 100, §100.10.

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP section.[29]

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[30] Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[31]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides.

VI. REFERENCES

~~1. Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."[32]~~

1. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Dynamic Effects Design Bases."[33]

2. 10 CFR Part 100, §100.10, "Factors to be Considered when Evaluating Sites."[34]

3. 10 CFR Part 100, §100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance."[35]

~~2~~4.[36] Regulatory Guide 1.76, "Design Base~~s~~is[37] Tornado for Nuclear Power Plants."

35. Regulatory Guide 1.91, "Evaluation of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants Sites."[38]

4. Standard Review Plan Section 2.2.3, "Evaluation of Potential Accidents."[39]

SRP Draft Section 3.5.1.5
Attachment A - Proposed Changes in Order of Occurrence

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for this SRP section.
2.	Current PRB names and abbreviations.	Editorial change made to reflect current secondary review responsibility for this SRP section.
3.	Editorial	Revised for consistency with the class of SSC identified in regulatory requirements (e.g., GDC 4) as requiring protection against missiles.
4.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for this SRP section.
5.	Editorial	Revised for consistency with the review described in subsections III.2 and III.3 which may involve review of missile effects on some nonsafety-related SSCs that are important to safety identified as requiring missile protection from the review described in SRP Section 3.5.2.
6.	SRP-UDP format item.	Revised review interface section of Areas of Review to be consistent with SRP-UDP required format that uses a number/paragraph format to distinguish individual reviews and supporting reviews performed by other PRBs.
7.	Editorial.	Added an introductory sentence for the review interface section that is consistent with the format used in the SRP-UDP.
8.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP section 3.5.2.
9.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP sections 2.2.1-2.2.2 and 2.2.3.
10.	Editorial.	Added a specific listing of SRP sections (2.2.1-2.2.2 and 2.2.3) that are consistent with the above areas of review discussion regarding the identification and characterization of offsite missiles that are required to be accommodated in the plant design basis.
11.	Editorial	Revised to improve grammar/clarity.
12.	Editorial.	The last sentence of the Areas of Review was revised so it is consistent with the SRP-UDP format. Added the phrase, "for the areas of review identified above" and made the sentence plural to reflect the fact that there is more than one review interface.

Item	Source	Description
13.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for this SRP section.
14.	Editorial.	The acronym SSC has been previously defined in the Areas of Review, therefore, the phrase "structures, systems and components was deleted.
15.	SRP-UDP format item, adding technical rationale.	Technical Rationale was developed and added for the Acceptance Criteria covering 10 CFR Part 100 § 100.10 and GDC 4. The SRP-UDP requires technical rationale be developed for the Acceptance Criteria.
16.	10 CFR 52 applicability issue.	A discussion was added addressing the applicability of the review procedures to the design certification process. The review of site proximity missiles under the 10 CFR 52 licensing process is the responsibility of the combined license applicant. This approach for the review procedures is consistent with the reviews documented in the ABWR FSER and the ABB-CE FSER (Reference PIs 24298 and 24299). An introduction to the review procedures was also added.
17.	USI Item B-3 Event Categorization.	The term "events" was substituted for the term "accidents" in Review Procedures step III.1. The resolution of USI B-3 requires that every instance of the term "accident" within the SRP be evaluated to ensure that the proper terminology is being used. The use of the term "accident" to describe events that could possibly generate missiles is not appropriate because such events do not directly involve limited fuel damage to the core.
18.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for this SRP section.
19.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP sections.
20.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for this SRP section.
21.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
22.	Editorial.	The acronym SSC for "structures, systems and components has been defined for its first usage in the Evaluation Findings.
23.	Editorial.	Replaced the phrase "structures, systems and components" with SSC to be consistent with the remainder of the section.

Item	Source	Description
24.	Editorial.	Replaced the phrase "structures, systems and components" with SSC to be consistent with the remainder of the section. Also revised the characterization of SSC evaluated (from safety-related to those requiring protection) for consistency with the review described in subsection III.2 which may involve evaluation of some nonsafety-related SSCs that are important to safety identified as requiring missile protection from the review described in SRP Section 3.5.2.
25.	Editorial.	Replaced the phrase "structures, systems and components" with SSC to be consistent with the remainder of the section.
26.	Editorial.	Replaced the phrase "structures, systems and components" with SSC to be consistent with the remainder of the section. Also revised the characterization of SSC evaluated (from safety-related to those needing detailed evaluation of their missile protection) for consistency with the review described in subsections III.2 and III.3 which may involve evaluation of some nonsafety-related SSCs that are important to safety identified as requiring missile protection from the review described in SRP Section 3.5.2.
27.	Editorial.	Replaced the phrase "structures, systems and components" with SSC to be consistent with the remainder of the section.
28.	Editorial.	Replaced the phrase "structures, systems and components" with SSC to be consistent with the remainder of the section. Also revised the characterization of SSC evaluated (from remaining safety-related SSC to remaining SSC requiring evaluation of their protection) for consistency with the review described in subsections III.2 and III.3 which may involve evaluation of some nonsafety-related SSCs that are important to safety identified as requiring missile protection from the review described in SRP Section 3.5.2.
29.	10 CFR 52 implementation.	A standard Evaluation Finding statement was added to address design certification and combined license reviews. The design certification and combined license evaluation finding statements are consistent with the SRP-UDP format and the documented findings in section 3.5.1.4 of the ABWR FSER and the ABB-CE FSER.
30.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.

Item	Source	Description
31.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
32.	Reference Verification.	The reference to Regulatory Guide 1.70 was deleted, this reference is not used by this section and was not cited.
33.	SRP-UDP format item	Added reference listing for GDC 4 since it is cited as Acceptance Criteria in subsection II.2.
34.	SRP-UDP format item	Added reference listing for 10 CFR 100.10 since it is cited as Acceptance Criteria in subsection II.1.
35.	SRP-UDP format item	Added reference listing for 10 CFR 100.11 as the location for the "10 CFR Part 100 exposure guidelines" cited in subsection II.1.
36.	Editorial.	The references were renumbered to reflect the deletion of Regulatory Guide 1.70.
37.	Reference Verification.	The title for Regulatory Guide 1.76 uses "basis" not "bases."
38.	Reference Verification	The title for Regulatory Guide 1.91 was changed, it ends with "Near Nuclear Power Plants" not "Near Nuclear Power Plant Sites."
39.	SRP-UDP format item	Deleted reference listing for SRP Section 2.2.3 per SRP-UDP standard practice which does not list other NUREG-0800 sections as references.

SRP Draft Section 3.5.1.5

Attachment B - Cross Reference of Integrated Impacts

Integrated Impact No.	Issue	SRP Subsections Affected
	No Integrated Impacts were incorporated in this SRP Section.	